angle of the recording light used to form the optical element and a polarization angle of the reproducing light before the reproducing light is acted on by the optical element.

REMARKS

Claims 1-55 are pending in this application. By this Amendment, claims 1, 4, 11, 21, 22, 26, 35, 37, 39, 40, 43, 46, 49 and 52-55 are amended for clarification purposes only. Reconsideration in view of the above amendments and following remarks is respectfully requested.

The attached Appendix includes marked-up copies of each rewritten claim (37 C.F.R. 1.121(c)(1)(ii)).

The Office Action rejects claims 1-10, 21, 35-39 and 55 under 35 U.S.C. §112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to make and/or use the invention. Applicant amends claims 1, 4, 21, 35, 37, 39 and 55 to obviate the rejection. Accordingly, Applicant respectfully requests that the rejection under 35 U.S.C. §112, first paragraph, be withdrawn.

The Office Action rejects claims 1-34, 36, 38 and 41-55 under 35 U.S.C. §102(b) as being anticipated by Tsujioka (U.S. Patent No. 5,316,900); and claims 35, 37, 39 and 40 are rejected under 35 U.S.C. §103(a) as being unpatentable over Tsujioka in view of Chen (U.S. Patent No. 5,488,597). Applicant respectfully traverses the rejections.

In particular, Applicant asserts that neither Tsujioka nor Chen, either alone or in combination, disclose or suggest an optical recording medium having at least one optical recording layer that includes an optical recording material having at least one of a polymer or a liquid crystal polymer that changes a state of photo-induced birefringence in response to a recording light that is externally controlled from the optical recording medium to rotate a polarization angle of the recording light, the portion of the recording layer that changes a state

of photo-induced birefringence substantially acting optically as a half-wave plate, as recited in independent claim 1, and similarly recited in independent claims 21, 35, 37, 39 and 55.

Moreover, Applicant asserts that neither Tsujioka nor Chen, alone or in combination, disclose or suggest an optical recording medium having at least one optical recording layer including an optical recording material that changes a state of photo-induced birefringence in response to a recording light that is externally controlled from the optical recording medium to rotate a polarization angle of the recording light, a portion of the recording layer that changes a state of photo-induced birefringence substantially acting optically as a quarter-wave plate, as recited in independent claim 11, and similarly recited in independent claims 22, 26, 40, 43, 46, 49 and 52-54.

Finally, Applicant asserts that neither Tsujioka nor Chen, alone or in combination, disclose or suggest an optical recording apparatus, having at least a spatial modulator that controllably rotates a polarization angle of a recording light, as recited in independent claim 30.

Specifically, Tsujioka discloses a recording medium that has a constant birefringent property and an alterable photochromic property. See col. 1, lines 20-25. As shown in Fig. 1, a recording layer 2 is formed on a substrate 1, and a birefringent layer 3 is formed on the recording layer 2. See col. 8, lines 36-50. The birefringent layer 3 functions to change a state of birefringence of the polarization angle of a light beam. See col. 3, lines 2-4. The recording layer 2 contains a material that has an optical rotary power that is changed to record information. See col. 3, lines 18-20. The optical rotary power rotates the plane of polarization of a linearly polarized light beam which is introduced into and transmitted into the recording material. See col. 1, lines 50-57. Fig. 4 shows that a polarizer 7 removes random-polarized spontaneous emission components from the light beam produced from the semi-conductor laser 5. See col. 9, lines 60-64.

Chen discloses a multilayer optical memory of interleaved optical recording media layers and control layers. See col. 1, lines 5-7. As seen in Figs 1-3, a memory 10 comprises an assembly of a plurality of interleaved optical recording media layers 12 and control layers 14. See col. 2, lines 16-34. A light beam 16 is directed through a polarizer 18 to establish an initial polarized condition for the light beam and scan the memory assembly. The control layers 14 establish an additional polarized condition for the light beam 16 and determine which of the recording layers 12 are subject to interaction with the light beam 16.

In stark contrast to Applicant's claimed invention, neither Tsujioka nor Chen disclose or suggest an optical recording medium having at least one optical recording layer that includes an optical recording material having at least one of a polymer or a liquid crystal polymer that changes a state of photo-induced birefringence in response to a recording light that is externally controlled from the optical recording medium to rotate a polarization angle of the recording light, the portion of the recording layer that changes a state of photo-induced birefringence substantially acting optically as a half-wave plate.

Moreover, neither Tsujioka nor Chen disclose or suggest an optical recording medium having at least one optical recording layer including an optical recording material that changes a state of photo-induced birefringence in response to a recording light that is externally controlled from the optical recording medium to rotate a polarization angle of the recording light, a portion of the recording layer that changes a state of photo-induced birefringence substantially acting optically as a quarter-wave plate.

Finally, neither Tsujioka nor Chen disclose or suggest an optical recording apparatus, having at least a spatial modulator that controllably rotates a polarization angle of a recording light.

On the contrary, Tsujioka discloses that the optical rotary power of the recording layer rotates the plane of polarization of the light beam which is introduced into and transmitted

into the recording material. Thus, the recording light is not externally controlled from an optical recording medium by a spatial modulator to rotate a polarization angle of the recording light. Instead, as shown in Fig. 4, the polarizer 7 removes random-polarized spontaneous emission components from the light beam produced from the semi-conductor laser 5, and does not externally control a recording light to rotate a polarization angle of the recording light. Furthermore, the polarizer 18 in Chen polarizes the light beam 16 so that the control layers 14 can additionally polarize the light beam 16 and direct the light beam 16 to specific recording layers that are to be subject to interaction with a light beam 16. Thus, the polarizer 18 in Chen does not externally control from an optical recording medium a recording light to rotate a polarization angle of the recording light.

Accordingly, Applicant asserts that neither Tsujioka nor Chen, alone or in combination, disclose or suggest all of the features of any one of independent claims 1, 11, 21, 22, 26, 30, 35, 37, 39, 40, 43, 46, 49 and 52-55. Thus, Applicant asserts that these independent claims define patentable subject matter. Claims 2-10, 12-20, 23-25, 27-29, 31-34, 36, 38, 41, 42, 44, 45, 47, 48, 50 and 51 depend from the independent claims and therefore also define patentable subject matter. Accordingly, Applicant respectfully requests that the rejection of claims 1-55 under 35 U.S.C. §102(b) and 35 U.S.C. §103(a) be withdrawn.

In view of the foregoing remarks, Applicant submits that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1-55 are earnestly solicited.

Should the Examiner believe anything further is desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact Applicant's attorney at the telephone number listed below.

Respectfully submitted,

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JAO:RSE/ala
Attachment:
Appendix

Date: June 28, 2001

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DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry;
Charge any fee due to our Deposit Account No. 15-0461

APPENDIX

Changes to Claims:

The following is a marked-up version of the amended claims:

1. (Twice Amended) An optical recording medium comprising at least one optical recording layer, the optical recording layer including an optical recording material having at least one of a polymer or a liquid crystal polymer that changes a state of photo-induced birefringence in response to a recording light that is externally controlled from the optical recording medium to rotate a polarization angle of the recording light, a portion of the recording layer that changes a state of photo-induced birefringence ~~rotates a polarization angle of the portion~~ substantially acting optically as a half-wave plate.

4. (Amended) The optical recording medium as in Claim 1, wherein said ~~optical recording material comprises a~~ polymer or a liquid crystal polymer comprises ~~in which~~ a side chain that includes a group which is photoisomerized.

11. (Twice-Amended) An optical recording medium comprising:

at least one optical recording layer including an optical recording material that changes a state of photo-induced birefringence in response to a recording light that is externally controlled from the optical recording medium to rotate a polarization angle of the recording light, a portion of the recording layer that changes a state of photo-induced birefringence ~~rotates a polarization angle of the portion~~ substantially acting optically as a quarter-wave plate; and

an optical reflection layer formed on one surface of said optical recording layer.

21. (Twice-Amended) An optical recording medium comprising an optical recording layer that includes a material having at least one of a polymer or a liquid crystal polymer in which an azimuth of birefringence that is induced by a recording light externally

controlled from the optical recording medium to rotate a polarization angle of the recording light changes in response to a rotation of the polarization angle of said recording light.

22. (Twice-Amended) An optical recording method comprising:

controlling a polarization angle of a recording light emitted from a light source, the recording light externally controlled from an optical recording medium to rotate the polarization angle of the recording light;

illuminating~~on~~ the~~an~~ optical recording medium with said recording light; and

forming an optical element on the optical recording medium by the illumination, that acts substantially as a half-wave plate, having an azimuth corresponding to a polarization angle on the optical recording medium.

26. (Twice-Amended) An optical recording method comprising:

controlling a polarization angle of a recording light emitted from a light source , the recording light externally controlled from an optical recording medium to rotate the polarization angle of the recording light;

illuminating the~~an~~ optical recording medium with said recording light; and

forming an optical element on the optical recording medium by the illumination, that acts substantially as a quarter-wave plate, having an azimuth corresponding to a polarization angle on the optical recording medium.

35. (Twice-Amended) An optical recording medium comprising an optical recording layer including an optical recording material having at least one of a polymer or a liquid crystal polymer that stores multilevel information using a light induced birefringence that acts optically as a half-wave plate, an orientation of an azimuth of birefringence formed by a recording light representing the multilevel information, the recording light externally controlled from the optical recording medium to rotate a polarization angle of the recording light.

37. (Twice-Amended) An optical recording medium comprising an optical recording layer including an optical recording material having at least one of a polymer or a liquid crystal polymer that stores multilevel information using a light induced birefringence that acts optically as a quarter-wave plate, at orientation of an azimuth of birefringence induced by controllably rotating a polarization angle of a recording light externally from the optical recording medium that represents~~ing~~ the multilevel information.

39. (Twice-Amended) An optical recording medium comprising an optical recording layer having at least one of a polymer or a liquid crystal polymer in which an azimuth of birefringence induced by controllably rotating a polarization angle of a recording light externally from the optical recording medium is multilevel-modulated and recorded in response to a rotation of a polarization angle of said recording light.

40. (Twice-Amended) An optical reproducing method comprising:

radiating a reproducing light on an optical recording medium in which an azimuth of an optical element that acts substantially as a half-wave plate is multilevel recorded in response to a polarization angle of a recording light that is externally controlled from the optical recording medium to rotate the polarization angle of the recording light; and

determining a polarization angle of the reproducing light transmitted by said optical element.

43. (Twice-Amended) An optical reproducing method comprising:

radiating reproducing light on an optical recording medium in which an azimuth of an optical element that acts substantially as quarter-wave plate is multilevel-recorded in response to a polarization angle of a recording light that is externally controlled from the optical recording medium to rotate the polarization angle of the recording light; and

determining a polarization angle reproducing light reflected from said optical element.

46. (Twice-Amended) An optical reproducing apparatus comprising:

a reproducing light optical system for transmitting reproducing light to an optical recording medium in which an azimuth of an optical element that acts substantially as a half-wave plate is multilevel recorded in response to a polarization angle of a recording light that is externally controlled from the optical recording medium to rotate the polarization angle of the recording light; and

an analyzing unit that detects a polarization angle of reproducing light transmitted by said optical element.

49. (Twice-Amended) An optical reproducing apparatus comprising:

a reproducing light optical system for emitting reproducing light toward an optical recording medium in which an azimuth of an optical element that acts substantially as a quarter-wave plate is multilevel recorded in response to a polarization angle of a recording light that is externally controlled from the optical recording medium to rotate the polarization angle of the recording light; and

an analyzing unit that detects a polarization angle of reproducing light reflected by an optical reflection layer and transmitted by said optical element.

52. (Twice-Amended) An optical recording and reproducing apparatus comprising:

a light source that generates a recording light;

a polarization rotary device that rotates a polarization angle of said recording light;

a focusing optical system that irradiates an optical recording medium with said recording light obtained from said polarization rotary device;

a reproducing light optical system that irradiates said optical recording medium with reproducing light; and

an analyzing unit that detects a polarization angle of reproducing light acted on by said optical recording medium.

53. (Twice-Amended) A method for optically recording and reproducing information, comprising:

controlling a polarization angle of a recording light emitted from a light source, the recording light controlled externally from an optical recording medium to rotate the polarization angle of the recording light;

illuminating ~~an~~ the optical recording medium with said recording light;

forming an optical element on the optical recording medium by the illumination having an azimuth corresponding to a polarization angle on the optical recording medium;

radiating reproducing light on the optical recording medium; and

determining a polarization angle of reproducing light acted on by said optical element.

54. (Twice-Amended) A device for optically recording and reproducing information, comprising:

controlling means for controlling a polarization angle of a recording light emitted from a light source, the recording light controlled externally from an optical recording medium to rotate the polarization angle of the recording light;

forming means for forming an optical element on ~~an~~the optical recording medium by the illumination having an azimuth corresponding to a polarization angle on the optical recording medium;

illumination means for radiating reproducing light on the optical recording medium; and

determining means for determining a polarization angle of reproducing light acted on by said optical element.

55. (Twice-Amended) An optical recording medium comprising an optical recording layer having at least one of a polymer or a liquid crystal polymer in which an optical element is formed by a recording light that is externally controlled from the optical recording medium to rotate a polarization angle of the recording light, the optical element having an azimuth of birefringence and acting on reproducing light to adjust a polarization angle of the reproducing light by an amount greater than a difference between a polarization angle of the recording light used to form the optical element and a polarization angle of the reproducing light before the reproducing light is acted on by the optical element.